

Simulation Model

Vertical cylinder $L = 30$ mm, $2R = 1$ or 3 mm

Thermal boundary conditions

horizontal $T = T_1 - T_2$

vertical T_z

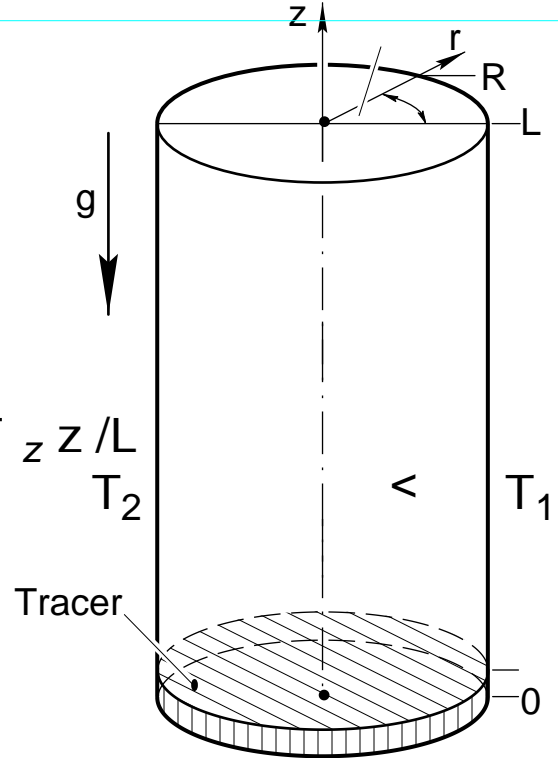
wall

$$T(R, \theta, z) = (T_1 + T_2)/2 + (T_1 - T_2) (\cos \theta)/2 + T_z z/L$$

bottom

$$T(r, \theta, 0) = (T_1 + T_2)/2 + (T_1 - T_2) r (\cos \theta)/2R$$

$$\text{top } T(r, \theta, L) = T(r, \theta, 0) + T_z$$



Initial condition

$$c(z, 0) = c_0, \quad 0 \leq z \leq L, \quad \text{and} \quad c(z, 0) = 0, \quad z > L,$$

where $L/L \ll 1$

Transport equations

$$\begin{aligned} \text{div } \mathbf{u} &= 0, \\ \mathbf{u} \cdot \text{grad } \mathbf{u} &= \frac{1}{\rho} \text{grad } p + \mathbf{u} \cdot \text{grad } T - (T - T_2)g\mathbf{k}, \\ \mathbf{u} \cdot \text{grad } T &= T. \end{aligned}$$

$$\frac{\partial c}{\partial t} + \mathbf{u} \cdot \text{grad } c = D \nabla^2 c$$

3D-time-dependent solutions based on properties of In at 1000 K